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(54) **HANDHELD MEASUREMENT TOOL WITH USER DEFINED DISPLAY**

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G01B 3/24	(2006.01)
G01B 3/28	(2006.01)
G06F 9/445	(2006.01)
G06F 9/44	(2006.01)

(52) **U.S. Cl.**

CPC .. ***G01B 3/24*** (2013.01); ***G01B 3/18*** (2013.01); ***G01B 3/22*** (2013.01); ***G01B 3/28*** (2013.01); *G06F 8/38* (2013.01); *G06F 9/4443* (2013.01); ***G06F 9/44505*** (2013.01)

USPC **33/784**

(58) **Field of Classification Search**

USPC 33/783, 784

See application file for complete search history.

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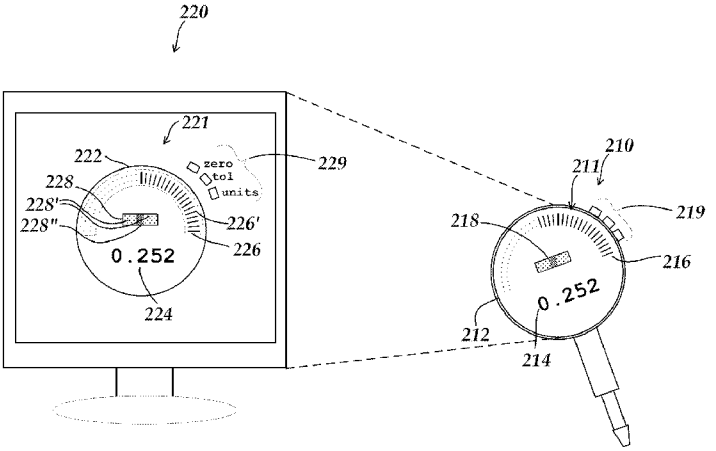
(57) **ABSTRACT**

A handheld measurement tool with a display that can be defined by a user. The handheld measurement tool may be a portable measurement gauge (e.g. a digital caliper, digital "dial" gauge, height gauge, micrometer, indicator, etc.) that may be utilized for measuring precise physical dimensions of workpieces. The display may be independently modified according to a customer's individual needs for various precision measurement applications. A remote device (e.g. PC, laptop, tablet, smartphone, etc.) may be utilized for reconfiguring the display, wherein a user can select and modify display format arrangements on the remote device. When the remote device is coupled to the portable measurement gauge, the gauge display is reconfigured so as to have a similar appearance to the defined display format arrangement. In certain embodiments, voice commands may be reconfigured and used for controlling the gauge display.

20 Claims, 6 Drawing Sheets



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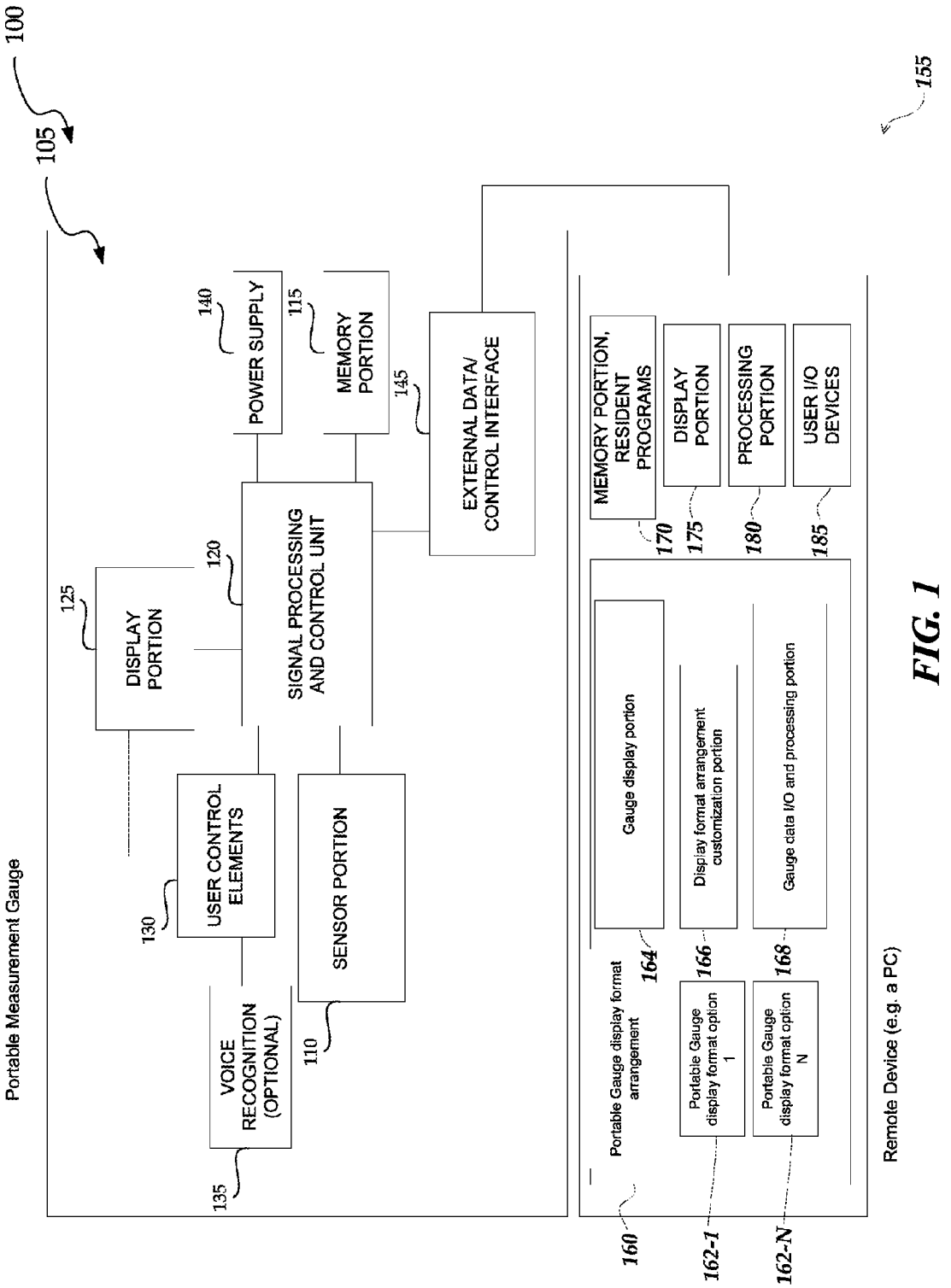
100
105
Portable Measurement Gauge
DISPLAY PORTION
125
SIGNAL PROCESSING AND CONTROL UNIT
120
POWER SUPPLY
140
MEMORY PORTION
115
EXTERNAL DATA/ CONTROL INTERFACE
145
USER CONTROL ELEMENTS
130
SENSOR PORTION
110
VOICE RECOGNITION (OPTIONAL)
135
155
Remote Device (e.g. a PC)
MEMORY PORTION, RESIDENT PROGRAMS
170
DISPLAY PORTION
175
PROCESSING PORTION
180
USER I/O DEVICES
185
Portable Gauge display format arrangement
164
Gauge display portion
Display format arrangement customization portion
166
Gauge data I/O and processing portion
168
Portable Gauge display format option 1
Portable Gauge display format option N
160
162-1
162-N

FIG. 1

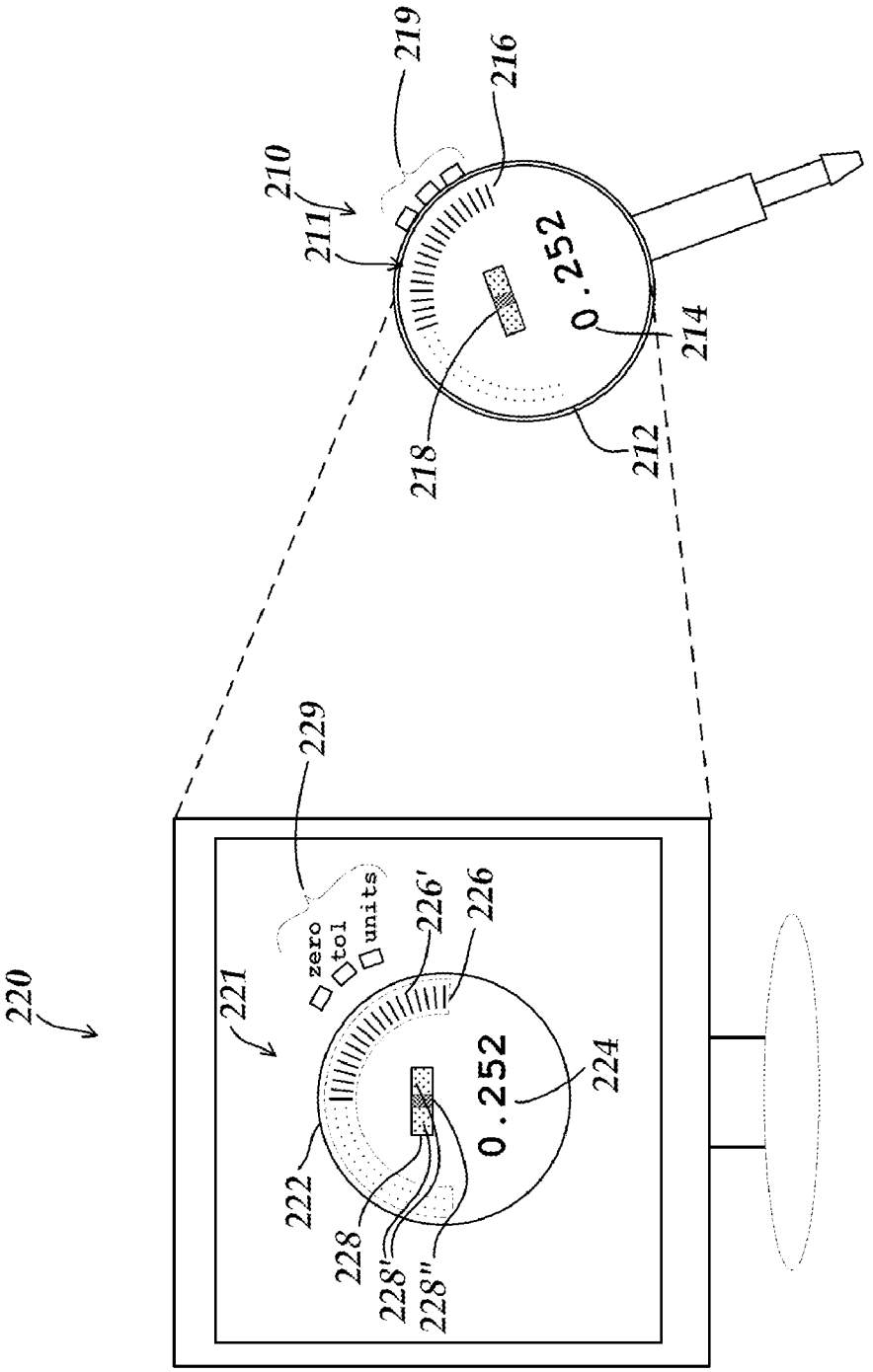
219
216
210
211
0.252
214
218
212
229
zero
tol
units
226'
226
220
221
0.252
224
222
228
228'
228"

FIG. 2

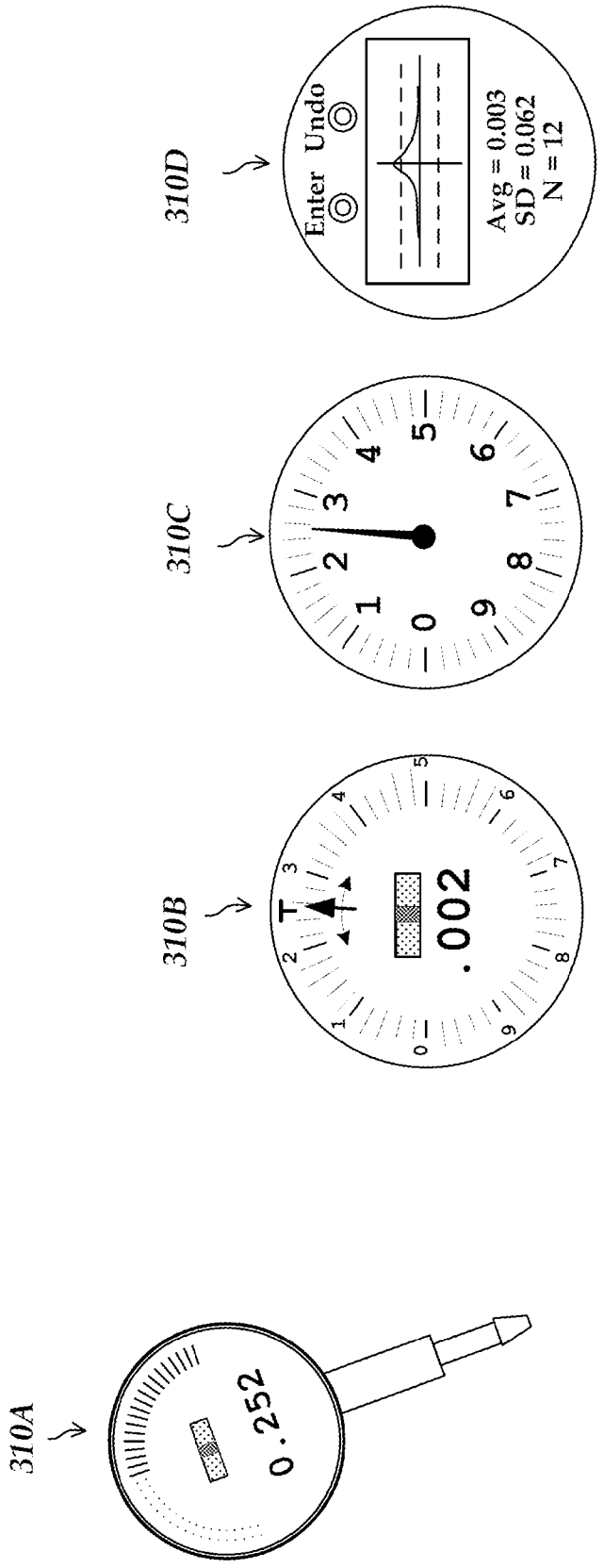

FIG. 3

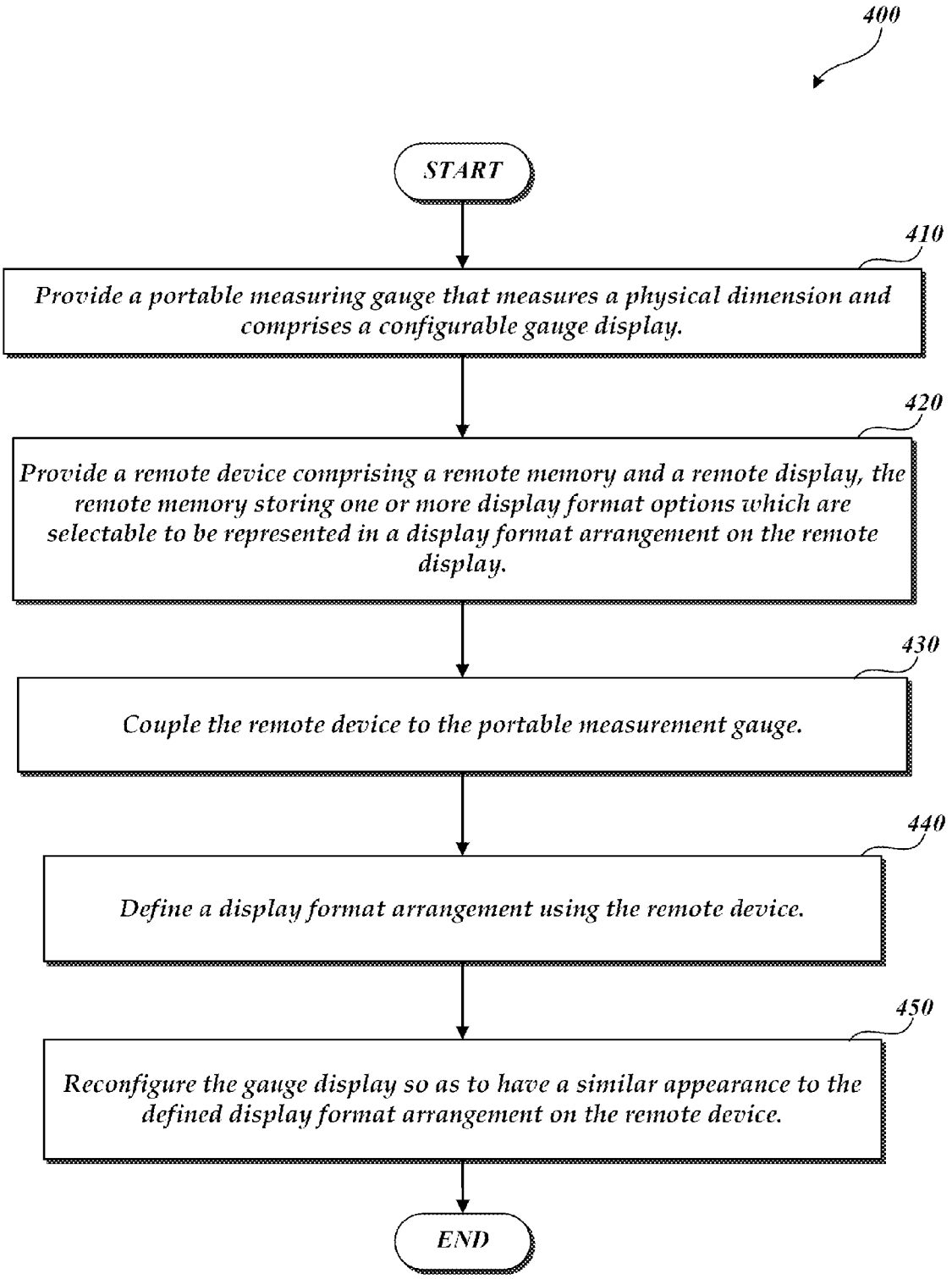
400
START
410
Provide a portable measuring gauge that measures a physical dimension and comprises a configurable gauge display.
420
Provide a remote device comprising a remote memory and a remote display, the remote memory storing one or more display format options which are selectable to be represented in a display format arrangement on the remote display.
430
Couple the remote device to the portable measurement gauge.
440
Define a display format arrangement using the remote device.
450
Reconfigure the gauge display so as to have a similar appearance to the defined display format arrangement on the remote device.
END

FIG. 4

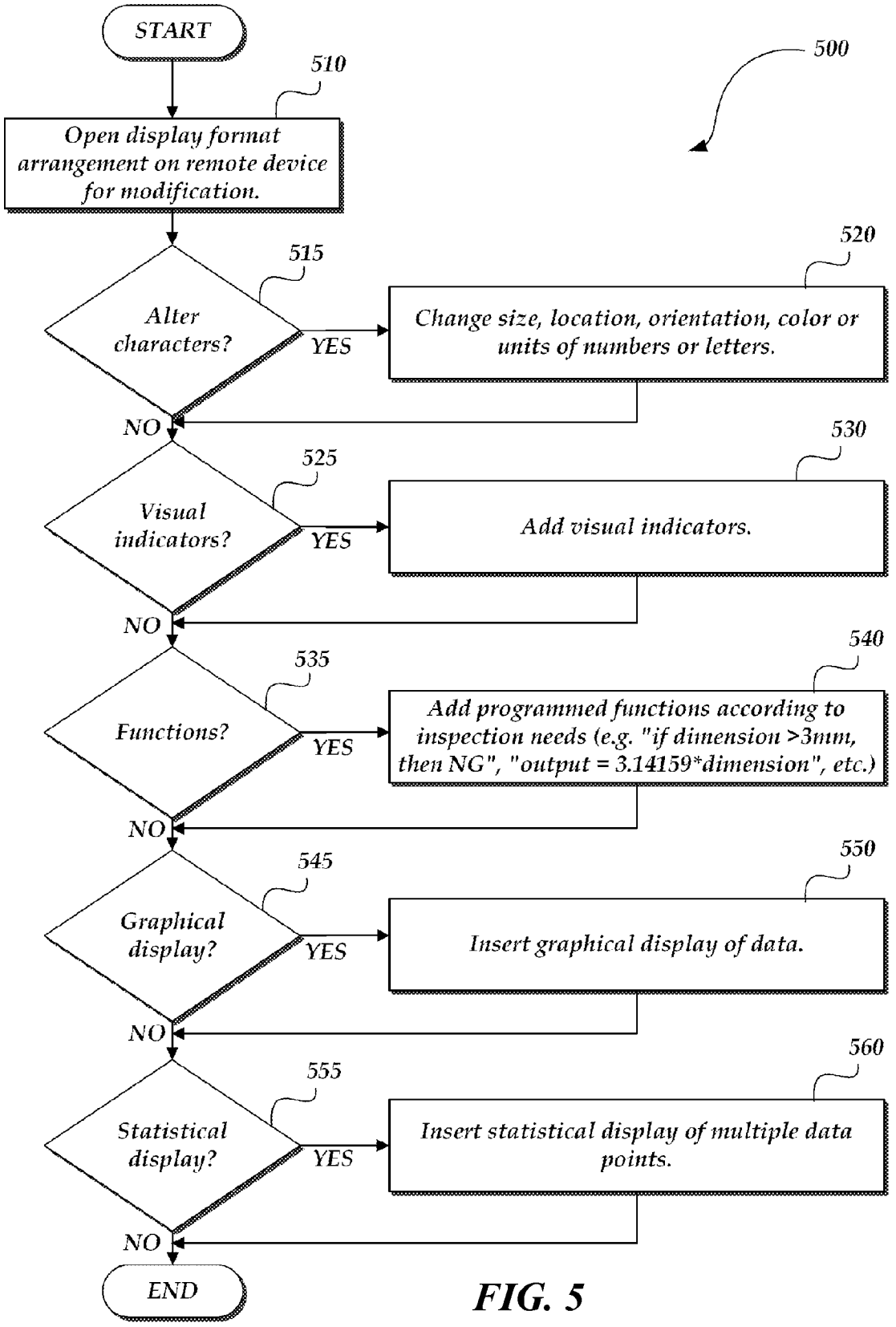
START
500
510
Open display format arrangement on remote device for modification.
515
Alter characters?
YES
520
Change size, location, orientation, color or units of numbers or letters.
NO
525
Visual indicators?
YES
530
Add visual indicators.
NO
535
Functions?
YES
540
Add programmed functions according to inspection needs (e.g. "if dimension >3mm, then NG", "output = 3.14159*dimension", etc.)
NO
545
Graphical display?
YES
550
Insert graphical display of data.
NO
555
Statistical display?
YES
560
Insert statistical display of multiple data points.
NO
END

FIG. 5

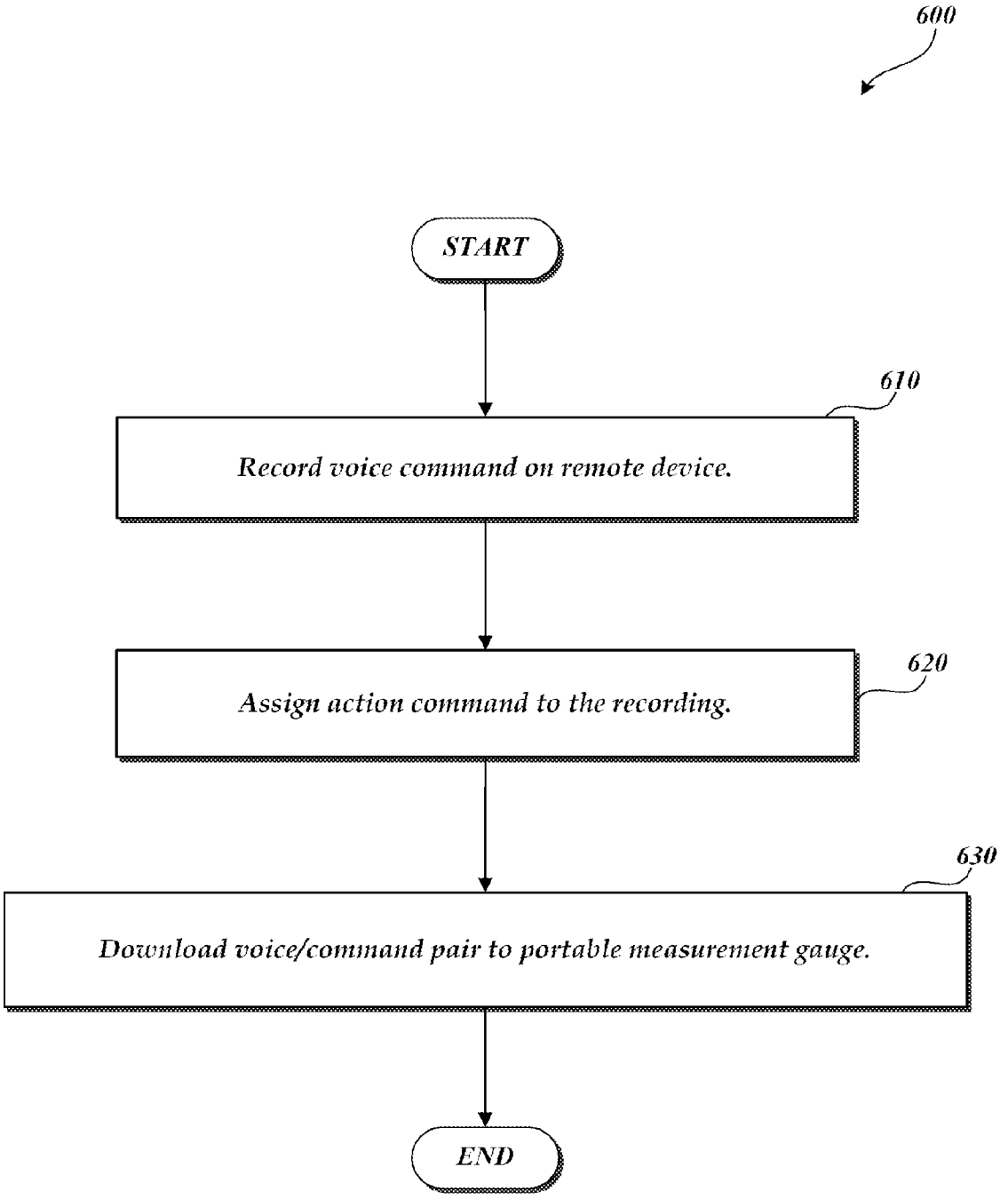
600
START
610
Record voice command on remote device.
620
Assign action command to the recording.
630
Download voice/command pair to portable measurement gauge.
END

FIG. 6

HANDHELD MEASUREMENT TOOL WITH USER DEFINED DISPLAY

BACKGROUND

One type of handheld measurement tool with a display is a portable measurement gauge. Certain types of portable measurement gauges (e.g. digital calipers, digital "dial" gauges, height gauges, micrometers, indicators, etc.) may be utilized for measuring precise physical dimensions (e.g. at the micron or sub-micron level) of workpieces. The displays for such devices are typically small, and often come in relatively fixed formats, where a user may at most be able to toggle between different pre-defined display modes. A need exists for users to be able to independently modify the appearance and functionality of such displays according to individual needs.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a system including a portable measurement gauge and a remote device.

FIG. **2** is a diagram illustrating a display of a portable measurement gauge as synchronized to a display of a remote device.

FIG. **3** is a diagram illustrating various display format arrangements for a portable measurement gauge.

FIG. **4** is a flow diagram illustrating one exemplary embodiment of a routine for utilizing a remote device for reconfiguring a display on a portable measurement gauge.

FIG. **5** is a flow diagram illustrating one exemplary embodiment of a routine illustrating specific example display format options.

FIG. **6** is a flow diagram illustrating one exemplary embodiment of a routine for recording a voice command for reconfiguring a portable measurement gauge.

DETAILED DESCRIPTION

In accordance with one aspect, a remote device is utilized for reconfiguring a display on a portable measurement gauge. The portable measurement gauge may be a precision measurement instrument (e.g. a digital caliper, digital "dial" gauge, height gauge, micrometer, indicator, etc.) The portable measurement gauge measures one or more physical dimensions of an object, and includes a configurable gauge display which indicates measurement information based on workpiece measurements performed by the portable measurement gauge. The remote device may be any of a number of different types of computing devices (e.g. a PC, laptop, tablet, smartphone, etc.) The remote device can be coupled by at least one of a wired or wireless connection to the portable measurement gauge, and includes a remote memory and a remote display. The remote memory stores one or more display format options which are selectable to be represented in a display format arrangement on the remote display. When the remote device is coupled to the portable measurement gauge and a user defines a display format arrangement using the remote device, the remote device commands the portable measurement gauge to reconfigure the gauge display so as to have a similar appearance to the defined display format arrangement.

In accordance with another aspect, at least one display format option may control at least one of a change in the size, location, orientation, color or units of at least one number or letter on the display that is related to or representative of a workpiece measurement performed by the portable measurement gauge. At least one display format option may represent

the addition of at least one visual indicator. At least one display format option may represent a function which may be modified by a user on the remote device and then represented on the gauge display. At least one display format option may represent a graphical display of measurement data. At least one display format option may represent a statistical display of a plurality of workpiece measurements performed by the portable measurement gauge.

In accordance with another aspect, at least one internal characteristic of the portable measurement gauge may be downloaded to the remote device to either activate or deactivate at least one display format option presented on the remote device. At least one internal characteristic of the portable measurement gauge may be downloaded to the remote device to be mimicked in a display format arrangement on the remote display. For example, an internal characteristic may be a color on the gauge display which is represented by a corresponding color in the display format arrangement on the remote display. In one embodiment, the remote device may download and save a current set of characteristics for the display of the portable measurement gauge, so that a previous configuration can be returned to, if desired.

In accordance with another aspect, the display format arrangement on the remote display is operational as the portable measurement gauge is used such that the behavior in response to any measurement operations can be viewed in the display format arrangement on the remote display. More generally, a real time link may be established when the portable measurement gauge is coupled to the remote device such that changes on one of the gauge display and remote display are mimicked on the other display in real time.

In accordance with another aspect, the remote device may be configured to be coupled by at least one of a wired or wireless connection to a first portable measurement gauge and at least a second portable measurement gauge comprising a configurable gauge display similar to the configurable gauge display of the first portable measurement gauge, and when a user defines a display format arrangement for the first portable measurement gauge using the remote device as outlined herein, the remote device is furthermore configured to command the second portable measurement gauge to reconfigure the gauge display of the second portable measurement so as to have a similar appearance to the defined display format arrangement of the first portable measurement gauge.

In accordance with another aspect, the portable measurement gauge further includes a voice input element that is capable of sensing a voice command from a user. The user may record a voice command on the remote device, and assign an action command (e.g. a display format option) to the recorded voice command. The display format option and associated voice command may then be downloaded to the portable measurement gauge. Then, in operation, when the associated voice command is sensed by the voice input element of the portable measurement gauge, the gauge display is controlled in accordance with the associated display format option. As a specific illustrative example, a user may record a voice command to "change units", wherein the gauge display will change from inches to mm.

Various embodiments of the invention are described below. The following description provides specific details for a thorough understanding and an enabling description of these embodiments. One skilled in the art will understand, however, that the invention may be practiced without many of these details. In addition, some well-known structures or functions may not be shown or described in detail, so as to avoid unnecessarily obscuring the relevant description of the various embodiments. The terminology used in the descrip-

tion presented below is intended to be interpreted in its broadest reasonable manner, even though it is being used in conjunction with a detailed description of certain specific embodiments of the invention.

FIG. **1** is a block diagram of a display configuration system **100** including a portable measurement gauge **105** and a remote device **155**. The portable measurement gauge **105** may be a precision measurement instrument (e.g. a digital caliper, digital "dial" gauge, height gauge, micrometer, indicator, etc.), and the remote device **155** may be any type of computing device (e.g. a PC, laptop, tablet, smartphone, etc.) As shown in FIG. **1**, the portable measurement gauge **105** includes a sensor portion **110**, a memory portion **115**, a signal processing and control unit **120**, a display portion **125**, user control elements **130**, a voice recognition portion **135**, a power supply **140**, and an external data/control interface **145**. The various portions of the portable measurement gauge **105** may be interconnected by one or more power and signal bus connections, or by individual dedicated connections. Various signal interconnections may be made by wireless and/or optical means, if desired.

The sensor portion **110** includes elements that are utilized for sensing the physical dimensions of a workpiece that is being measured. The memory portion **115** includes a storage medium, which may be used to save various system configuration parameters and/or operating instructions or routines, as well as to save various measurement results and/or user-created measurement routines, if desired. It will be appreciated that measurements taken by the device may also be saved in the memory portion **115**. In various exemplary embodiments the memory portion **115** may include ROM and/or RAM memory, and may be merged with, or indistinguishable from, the signal processing and control unit **120**.

The signal processing and control unit **120** controls the general operations of the portable measurement gauge **105**, and provides the output to the display portion **125**. As will be described in more detail below, the display portion **125** provides a configurable gauge display which indicates measurement information based on workpiece measurements performed by the portable measurement gauge **105**. The user control elements **130** allow a user to control the operations of the portable measurement gauge **105** (e.g., control buttons, touchscreen, etc.).

An (optional) voice recognition portion **135** may include a microphone and circuitry sufficient to receive and interpret various voice commands, and provide corresponding signals to the signal processing and control unit **120**. In general, the voice recognition portion **135** may provide a redundant method, or the only method, for performing any of the control operations, selection operations, and the like, that may be required for operating the portable measurement gauge **105**, including various operations described in association with various manual and/or visual user control elements herein. The voice recognition portion may also provide sound or voice synthesis if desired, such that various action confirmations, mode confirmations, control actions alternatives, measurement results, and the like, may be provided by audio output to the user. The voice recognition portion **135** may also include a training and/or programming capability that allows the creation of custom commands and/or recognition that is customized for a particular individual. In one embodiment, the voice recognition portion **135** may be implemented using commercially available voice recognition circuitry, software, and/or development tools if desired, such as those associated with RSC-4X or SVC-64 series of IC's available from Sensory® Inc., Santa Clara, Calif., for example.

In one specific example embodiment, the voice recognition portion **135** may be capable of sensing a voice command from a user related to controlling the gauge display. More specifically, as will be described in more detail below with respect to the remote device **155**, a user may record a voice command on the remote device, and assign an action command (e.g. a display format or mode option) to the recorded voice command. The display format option and associated voice command may be then downloaded and saved in the memory portion **115** of the portable measurement gauge **105**. Then, in operation, when the associated voice command is sensed by the voice recognition portion **135**, the display portion **125** may be made to show the gauge display in accordance with the associated display format or mode option. As a specific illustrative example, a user may record a voice command to "change units", wherein the gauge display will change from inches to mm. Techniques for recording and processing voice commands are described in more detail in U.S. Patent Pub. No. 2010/0088100, which is hereby incorporated by reference in its entirety.

The external data/control interface **145** may comprise suitable signal conditioning and/or interface protocol circuitry, as well any desired connector configuration(s), such that a remote device (e.g. remote device **155**) may be conveniently interfaced to the portable measurement gauge **105**. Portions of the external data/control interface **145** may be provided by, or merged with and indistinguishable from, the signal processing and control unit **120**. The external data/control interface **145** may also include a wired or wireless transmitting/receiving unit, which is used to transmit, or receive information to or from computers, instruments, or other devices usable in combination with the portable measurement gauge **105**. Such devices may provide programs or instructions that are created remotely from the portable measurement gauge **105**, for example by text-based programming, by a compatible program associated with a larger metrology system or other programming interface provided on a PC, or by a separate identical or compatible portable measurement gauge. The programs or instructions may correspond to workpieces that are to be inspected using the portable measurement gauge **105**, and may be downloaded or executable under control of the signal processing and control unit **120** through the external data/control interface **145**.

The remote device **155** includes a portable gauge display format arrangement portion **160**, a memory portion **170**, a display portion **175**, a processing portion **180** and a user input-output devices portion **185**. The portable gauge display format arrangement portion **160** includes a number of portable gauge display format options **162-1** to **162**-N, a gauge display portion **164**, a display format arrangement customization portion **166**, and a gauge data input-output and processing portion **168**. The portable gauge display format options **162-1** to **162**-N may be utilized to provide or alter various elements in the display format. For example, in one embodiment, the display format options may control at least one of a change in the size, location, orientation, color or units of at least one number or letter on the display that is related to or representative of a workpiece measurement performed by the portable measurement gauge. In certain implementations, at least one of the portable gauge display format options may represent the addition of at least one visual indicator (meaning a non-numerical indicator of a measurement characteristic, such as a pointer that "rotates" around the display, as will be described in more detail below with respect to the display format arrangement **310**C of FIG. **3**.) In some embodiments, at least one display format option may represent a function which may be modified by a user on the remote device **155**

and then represented in the gauge display of the portable measurement gauge **105** (e.g. "if dimension >3 mm, then NG", or "output=3.14159*dimension", etc.) In some embodiments, at least one display format option may represent a graphical or "quasi-analog" display of a measurement value (e.g. as will be described in more detail below with respect to the display format arrangement **310**C of FIG. **3**.). At least one display format option may represent a statistical display of a plurality of workpiece measurements performed by the portable measurement gauge **105** (e.g. as will be described in more detail below with respect to the display format arrangement **310**D of FIG. **3**.).

The gauge display portion **164** presents gauge display arrangement representations to the display portion **175**. In one embodiment, the gauge display portion **164** enables the display format arrangement on the display portion **175** to be operational as the portable measurement gauge **105** is utilized such that the behavior and response to any measurement operations can be viewed in the display format arrangement on the display portion **175**. More generally, a real time link may be established when the portable measurement gauge **105** is coupled to the remote device **155** such that changes on one of the gauge display portion **125** and remote display portion **175** are mimicked on the other display in real time.

The display format arrangement customization portion **166** provides for customization of the input-output, menus, etc. The gauge data input-output and processing portion **168** provides for various functions (e.g. gauge characteristic download, arrangement upload to gauge, real time display interaction, operation of the gauge as a slave when connected, etc.) Some of these types of functions are operational in some embodiments and non-operational in other embodiments.

The memory portion **170** includes resident programs and other data utilized by the remote device. The display portion **175** provides the display for the remote device **155**, including the features provided by the portable gauge display format arrangement portion **160**. The processing portion **180** provides for the signal processing and control of the remote device, while the user input-output devices portion **185** receives and provides control signals and output to and from various user devices (e.g. the portable measurement gauge **105**).

FIG. **2** is a diagram illustrating a display **210** of a portable measurement gauge as synchronized to a display **220** of a remote device. As shown in FIG. **2**, the display **210** includes a configurable gauge display **211** which indicates measurement information based on workpiece measurements performed by the portable measurement gauge. The remote display **220** has a corresponding display format arrangement **221** which has a similar appearance to the configurable gauge display **211**.

The defined display format arrangement **221** includes a border **222**, measurement value numbers **224**, a visual indicator **226** (meaning a non-numerical indicator of a measurement characteristic) and a visual indicator **228**. The visual indicator **226** comprises a quasi-analog tolerance measurement representation **226** comprising measurement scale increments **226'**, which may individually toggle between absence or presence in response to the measurement value (or changes in the measurement value) relative to a target value. The visual indicator **228** comprises a tolerance measurement representation **228** comprising a color zone **228"** (e.g. a green zone) corresponding to an "in tolerance" measurement value, and color zones **228'** (e.g. red zones) corresponding to an "out of tolerance" measurement values. Each of the color zones may toggle between color absence or presence in response to the measurement value (or changes in the measurement value) relative to a target value. The display **220** of the remote device may also include a schematic button representation **229** of manual pushbuttons included on the portable measurement gauge associated with the display format arrangement **221**. In one embodiment, the remote device may include a remote memory for storing one or more display format options, which correspond to the example elements **222**, **224**, **226** and **228** or the like, which may be selectable to be represented and customized (if desired) in the display format arrangement **221** on the remote display **220**. When the remote device is coupled (e.g. by a wired or wireless connection) to the portable measurement gauge, the remote device may command the portable measurement gauge to reconfigure the gauge display **211** so as to have a similar appearance to the defined display format arrangement **221** (e.g. by downloading certain control parameters that govern a routine that operates in the portable measurement gauge, or replacing all or part of the routine that operates in the portable measurement gauge, or the like). More specifically, on the configurable gauge display **211**, measurement numbers **214** are made to have a similar appearance to the measurement numbers **224**, and the visual indicators **216** and **218** are provided with a similar appearance to the a visual indicators **226** and **228**, respectively.

In certain implementations, the remote display is made to accurately reflect the gauge display (e.g. in terms of screen shape, pixel characteristics, etc.). As a specific illustrative example, the outer perimeter **212** of the display **210** is mimicked as illustrated by the border **222** of the display format arrangement **221**. In certain embodiments, the internal characteristics of the portable measurement gauge are downloaded, or an identifier is downloaded to recall a corresponding portable measurement gauge configuration file residing on the host of the remote display, to either activate of deactivate certain display format options and other features presented on the remote device. As one example, the gauge display pixel configuration or the custom LCD segment configuration which limit the customization options of the gauge display may be downloaded or recalled. As another example, if there is a true peak hold capability in the portable measurement gauge, then that may be offered as a display format option on the remote device. As another example, if the portable measurement gauge includes manual control buttons (e.g. the buttons **219**), then they may be mimicked on the display **220**, and/or operated and/or their functions changed as part of the process of modifying the display format arrangement **221**. As another example, if the portable measurement gauge has significant memory capability, then display format options may be presented corresponding to statistical display options, maximum/minimum readings, etc.

In addition, in certain implementations, various other display characteristics of the portable measurement gauge may be downloaded to the remote device to be mimicked in the display format arrangement **221** on the remote display. For example, if the display **210** is a color display on the gauge, the display format arrangement **221** may be correspondingly colored. In certain implementations, the remote device may include several gauge models, and the characteristics of the portable measurement gauge may be downloaded as a basis for determining which gauge models may be presented as options for the display format arrangement **221**. In certain embodiments, the remote device may also download and save a current set of parameters corresponding to the configurable gauge display **211**, so that after changes are made the portable measurement gauge can be returned to a previous configuration if desired.

In certain embodiments, the display format arrangement **221** on the remote display may be made to be operational as the portable measurement gauge is used such that the behavior in response to any measurement operations can be viewed in the display format arrangement **221**. As a specific illustrative example, as the measurement numbers **214** which represent workpiece measurements change, a corresponding change may be mimicked in the measurement numbers **224** in the display format arrangement **221**. In certain embodiments, such mimicking operations may be utilized as a "wandering interface terminal" for such portable measurement gauges. More generally, a real time link may be established when the portable measurement gauge is coupled to the remote device such that changes on one of the gauge display and remote display are mimicked on the other display in real time.

In certain embodiments, the remote device may be configured to be coupled by at least one of a wired or wireless connection to a first portable measurement gauge, and may also be subsequently or simultaneously coupled by at least one of a wired or wireless connection to at least a second portable measurement gauge comprising a configurable gauge display similar to the configurable gauge display of the first portable measurement gauge. Then, when a user defines a display format arrangement for the first portable measurement gauge using the remote device to perform operations such as those outlined above, the remote device is furthermore configured to command the second portable measurement gauge to reconfigure the gauge display of the second portable measurement so as to have a gauge display similar to the first portable measurement gauge.

FIG. **3** is a diagram illustrating various display format arrangements **310**A-**310**D for a portable measurement gauge. As shown in FIG. **3**, the display format arrangement **310**A is mimicked on a portable measurement gauge display, and is similar to the display format arrangement **221** of FIG. **2**. The display format arrangement **310**B illustrates a visual indicator comprising a circular scale with numbered increments and a quasi-analog pointer that points to the measurement value on the scale, with a measurement number that represents a deviation from a target measurement value (e.g. a target value as may be set using a button on the side or face of the portable measurement gauge according to known methods), as well as a visual indicator comprising an in/out of tolerance representation (e.g. such as the visual indicator **228**) located in the middle. The display format arrangement **310**C illustrates an incremented circular scale with a quasi-analog pointer element in the middle which "rotates" to indicate a measurement value. The display format arrangement **310**D provides a graphical display along with numerical representations of statistical measurement data. In one embodiment, the display format arrangement **310**D may provide a bar chart or other graphical representation of multiple measurements that have been taken with the portable measurement gauge. When the portable measurement gauge display is a touch screen type display, the display format arrangement **310**D may also comprise the touch-sensitive "soft" control button representations labeled "Enter" and "Undo" in display format arrangement **310**D. It will be understood that the location, appearance, function and labels of such button representations may be mimicked and configured in the same manner as outlined above with respect to other features of the configurable gauge display.

FIG. **4** is a flow diagram illustrating one exemplary embodiment of a routine **400** for utilizing a remote device for reconfiguring a display on a portable measurement gauge. As shown in FIG. **4**, at a block **410**, a portable measurement gauge is provided that measures a physical dimension and comprises a configurable gauge display. At a block **420**, a remote device is provided comprising a remote memory and a remote display, the remote memory storing one or more display format options which are selectable to be represented in a display format arrangement on the remote display. At a block **430**, the remote device is coupled to the portable measurement gauge. At a block **440**, a display format arrangement is defined using the remote device. At a block **450**, the gauge display is reconfigured so as to have a similar appearance to the defined display format arrangement on the remote device.

FIG. **5** is a flow diagram illustrating one exemplary embodiment of a routine **500** illustrating specific example display format options. As shown in FIG. **5**, at a block **510**, a display format arrangement is opened for modification on a remote device (e.g. a PC, laptop, tablet, smartphone, etc.) At a decision block **515**, a determination is made as to whether the appearances of any characters are to be altered. If any characters are to be altered, then the routine continues to a block **520**, where the size, location, orientation, color or units of numbers or letters are changed. If no characters are to be altered, then the routine continues to a decision block **525**.

At the decision block **525**, a determination is made as to whether any visual indicators are to be added. If any visual indicators are to be added, then the routine continues to a block **530**, where the visual indicators are added. If no visual indicators are to be added, then the routine continues to a decision block **535**.

At the decision block **535**, a determination is made as to whether any functions are to be added. If any functions are to be added, then the routine continues to a block **540**, where various types of programmed functions are added, according to the specific inspection needs (e.g. "if dimension >3 mm, then NG", or "output=3.14159*dimension", etc.) if no functions are to be added, then the routine continues to a decision block **545**.

At the decision block **545**, a determination is made as to whether a graphical display of data is to be inserted. If a graphical display is to be inserted, then the routine continues to a block **550**, where the graphical display of the data is inserted. If no graphical display is to be inserted, then the routine continues to a decision block **555**.

At the decision block **555**, a determination is made as to whether a statistical display of multiple data points is to be inserted. If a statistical display is to be inserted, then the routine continues to a block **560**, where the statistical display of the multiple data points is inserted. If no statistical display is to be inserted, then the routine ends.

FIG. **6** is a flow diagram illustrating one exemplary embodiment of a routine **600** for recording a voice command for reconfiguring a portable measurement gauge. As shown in FIG. **5**, at a block **610**, a user records a voice command on the remote device. At a block **620**, an action command is assigned to the recording. At a block **630**, the voice/action pair is downloaded to the portable measurement gauge. A user may then utilize the recorded voice command for controlling the display and/or operating mode on the portable measurement gauge. As a specific example operation where the voice command is recorded for "change units" (e.g. from inches to mm), a user may speak this command to the portable measurement gauge, which would then change from inches to mm for the measurement(s) indicated on the display.

It will be appreciated that in accordance with the previously described embodiments, a user is able to independently modify the appearance and functionality of a display for a portable measurement gauge, according to individual needs. The utilization of the remote device allows the display param-

eters to be easily selected and modified, even for portable measurement gauges where the display size is generally small and for which touchscreen operations would be difficult to implement, in certain implementations, the remote device may include skins, editable/selectable skin components, bitmap editing capability, etc. for implementing certain of the above described display reconfiguration operations. While the reconfiguration elements have generally been described as being stored in the memory of the remote device, such may also reside in other locations (e.g. the Internet, etc.), with the remote device functioning as a link that passes the key parameters.

From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

We claim:

1. A system for modifying a gauge display that presents workpiece measurement information on a portable measurement gauge, the system comprising:

a first portable measurement gauge which measures one or more physical dimensions of an object, the first portable measurement gauge comprising a configurable gauge display which indicates measurement information based on workpiece measurements performed by the first portable measurement gauge; and

a remote device that can be coupled by at least one of a wired or wireless connection to at least the first portable measurement gauge, the remote device comprising a remote memory and a remote display, the remote memory storing one or more display format options which are selectable to be represented in a display format arrangement on the remote display, wherein when the remote device is coupled to the first portable measurement gauge and a user defines a display format arrangement using the remote device, the remote device commands the first portable measurement gauge to reconfigure the gauge display so as to have a similar appearance to the defined display format arrangement.

2. The system of claim **1**, wherein the remote device is one of a PC, laptop, tablet or smartphone.

3. The system of claim **1**, wherein the first portable measurement gauge is one of a digital caliper, digital "dial" gauge, height gauge, micrometer or indicator.

4. The system of claim **1**, wherein at least one display format option controls at least one of a change in the size, location, orientation, color or units of at least one number or letter on the display that is related to or representative of a workpiece measurement performed by the first portable measurement gauge.

5. The system of claim **1**, wherein at least one display format option represents the addition of at least one visual indicator.

6. The system of claim **1**, wherein at least one display format option represents a function which may be modified by a user on the remote device and then represented on the gauge display.

7. The system of claim **1**, wherein at least one display format option represents a graphical display of measurement data.

8. The system of claim **1**, wherein at least one display format option represents a statistical display of a plurality of workpiece measurements performed by the first portable measurement gauge.

9. The system of claim **1**, wherein at least one internal characteristic of the first portable measurement gauge is downloaded to the remote device to either activate or deactivate at least one display format option presented on the remote device.

10. The system of claim **1**, wherein at least one internal characteristic of the first portable measurement gauge is downloaded to the remote device to be mimicked in a display format arrangement on the remote display.

11. The system of claim **10**, wherein the internal characteristic is a color on the gauge display which is represented by a corresponding color in the display format arrangement on the remote display.

12. The system of claim **1**, wherein the display format arrangement on the remote display is operational as the first portable measurement gauge is used such that the behavior in response to any measurement operations can be viewed in the display format arrangement on the remote display.

13. The system of claim **1**, wherein a real time link may be established when the first portable measurement gauge is coupled to the remote device such that changes on one of the gauge display or remote display are mimicked on the other display in real time.

14. The system of claim **1**, wherein the first portable measurement gauge further comprises a voice input element that is capable of sensing a voice command from a user, and the remote device further associates a voice command with a display format option, wherein the display format option and associated voice command may be downloaded to the first portable measurement gauge such that when the associated voice command is sensed by the voice input element of the first portable measurement gauge, the gauge display is controlled in accordance with the associated display format option.

15. The system of claim **1**, further comprising at least a second portable measurement gauge which measures one or more physical dimensions of an object, the second portable measurement gauge comprising a configurable gauge display which indicates measurement information in a manner similar to the configurable gauge display of the first portable measurement gauge, based on workpiece measurements performed by the second portable measurement gauge, wherein:

the remote device is furthermore configured to be coupled by at least one of a wired or wireless connection to the second portable measurement gauge; and

when a user defines a display format arrangement for the first portable measurement gauge using the remote device, the remote device is furthermore configured to command the second portable measurement gauge to reconfigure the gauge display of the second portable measurement so as to have a similar appearance to the defined display format arrangement.

16. A system for modifying a gauge display that presents workpiece measurement information on a portable measurement gauge, the system comprising:

a portable measurement gauge which measures one or more physical dimensions of an object, the portable measurement gauge comprising a configurable gauge display and a voice input element, the configurable gauge display indicating measurement information based on workpiece measurements performed by the portable measurement gauge, and the voice input element being capable of sensing a voice command from a user; and

a remote device that can be coupled by at least one of a wired or wireless connection to the portable measurement gauge, the remote device comprising a remote

memory and a remote display, the remote memory storing one or more display format options, wherein when a voice command is defined as being associated with a display format option, the display format option and associated voice command may be downloaded to the portable measurement gauge such that when the associated voice command is sensed by the voice input element of the portable measurement gauge, the gauge display is controlled in accordance with the associated display format option.

17. The system of claim **16**, wherein the portable measurement gauge is one of a digital caliper, digital "dial" gauge, height gauge, micrometer or indicator.

18. The system of claim **16**, wherein the associated voice command controls at least one of a change in the size, location, orientation, color or units of at least one number or letter on the display that is related to or representative of a workpiece measurement performed by the portable measurement gauge, or the addition of at least one visual indicator to the display.

19. A non-transitory, computer readable media with instructions stored thereon that are executable by a processor to perform operations of:

providing one or more display format options on a remote display of a remote device, wherein the remote device may be coupled by at least one of a wired or wireless connection to a portable measurement gauge which measures one or more physical dimensions of an object and comprises a configurable gauge display which indicates measurement information based on workpiece measurements performed by the portable measurement gauge;

providing a display format arrangement on the remote display corresponding to one or more selected display format options; and

reconfiguring the gauge display on the portable measurement gauge so as to have a similar appearance to a defined display format arrangement on the remote display of the remote device when the remote device is coupled to the portable measurement gauge and a display format arrangement is defined on the remote device.

20. The non-transitory, computer readable media of claim **19**, wherein the portable measurement gauge is one of a digital caliper, digital "dial" gauge, height gauge, micrometer or indicator.

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